

Appendix A

Appendix A

Records of Decision (RODs) for Operable Unit 1, Operable Unit 2 and Operable Unit 3.

- A-1. Amended ROD for Operable Unit 1, dated September 21, 2006
- A-2. ROD for Operable Unit 2, dated June 12, 2001
- A-3. ROD for Operable Unit 3, dated September 21, 2006

A-1. Amended ROD for Operable Unit 1, dated September 21, 2006
Part 1 of 2

EPA Superfund
Record of Decision Amendment:

SANFORD GASIFICATION PLANT
EPA ID: FLD984169193
OU 01
SANFORD, FL
09/21/2006

AMENDED
RECORD OF DECISION
OPERABLE UNIT ONE

SANFORD GASIFICATION PLANT SITE
SANFORD, SEMINOLE COUNTY, FLORIDA



PREPARED BY:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

ATLANTA, GA



10457516

**AMENDED RECORD OF DECISION
OPERABLE UNIT ONE
SANFORD GASIFICATION PLANT SITE**

Declaration

Site Name and Location

Sanford Gasification Plant Site
Sanford, Seminole County, Florida
FLD984169193

Statement of Basis and Purpose

This decision document presents the amended selected remedial action for the Operable Unit One (OU1) Sanford Gasification Plant Site ("the Site"), in Sanford, Seminole County, Florida, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based on the Administrative Record (AR) for the Site. The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has been the support agency during the remedial investigation/feasibility study process for the Site. In accordance with 40 CFR§300.430, as the support agency, FDEP has provided input during this process and has actively participated in the decision making process.

Assessment of the Site

Unacceptable risk associated with this Site is due to the potential ingestion of or dermal contact with contaminated soil as well as potential release of hazardous substances into the groundwater in contact with contaminated subsurface soils. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Amended Record of Decision (AROD), may present endangerment to public health and welfare and further harm to the environment.

Description of the Selected Remedy

The original OU1 Record of Decision (ROD) is being amended because new information obtained during the Design Sampling and Analysis investigation conducted after the execution of the original OU1 ROD indicated that the scope and cost of the remedy originally selected would change fundamentally. This new information substantially supports the need to change the primary treatment method due to a significant increase in the volume of soil to be addressed thereby significantly increasing the costs of the original remedy. Furthermore, this change in the

treatment method and cost increase represents a number of significant changes that together have an effect of a fundamental change.

The amended remedy addresses the main threat associated with OU1 (soils) of the Site. After reviewing the information available and after careful consideration of the various alternatives, EPA is selecting a combination of In-Situ Solidification/Stabilization (ISS), off-site disposal and optional Chemical Oxidation in non-Nonaqueous Phase Liquid (non-NAPL) areas. EPA has selected an alternative that not only protects human health and the environment but also reduces mobility, toxicity and volume of contaminated soil to be sent for off-site disposal. Soil excavated to account for bulking that does not exceed residential levels may be used without restrictions as clean fill for the final soil cap or as fill material in other areas. The alternative is consistent with EPA's preference for a treatment alternative that achieves these goals. This is believed to be the most effective alternative taking in consideration time to be implemented, cost, and long-term effectiveness.

The remedy consists of implementing the following actions:

- Removal of the upper 2 feet of soil to risk-based levels and off-site disposal in a RCRA Subtitle D landfill;
- Treatment of subsurface soils impacting groundwater using ISS which will include the injection of a treatment reagent (i.e., Portland Cement) into the subsurface soil while the soil is mixed in-Situ using appropriate heavy construction equipment (i.e., a large diameter auger) at an anticipated depth of 2 to approximately 30 feet below land surface;
- Removal of comparatively shallower soil to account for bulking to accommodate the ISS process and off Site disposal in a RCRA Subtitle D landfill;
- Conduct a bench and pilot test which will involve mixing a variety of reagents at varying concentrations with Site-area soil types to select the optimal reagent and injection rate;
- Use of Chemical Oxidation as a means to address those perimeter areas that fall under certain non-NAPL characteristics.
- Use of Institutional Controls to reduce the potential risk associated with exposure to impacts at the Site to those adjacent properties affected by the implementation of the remedy. The Institutional Controls will be implemented after construction of the remedy and drafted in accordance with FDEP's Institutional Controls Procedures Guidance. Restrictive Covenants will be used to document the requirements and restrictions placed on the subject property and will be filed with the county land office. Some of the controls which will be generally implemented include, but are not limited to, the following:

- a. No well shall be installed without EPA's written approval and no groundwater shall be used for any other purpose other than monitoring for contamination purposes;
- b. No excavation shall occur in any of the treated areas without written approval from EPA and FDEP; and
- c. Provide permanent access to subject property to EPA and FDEP and their agents and/or representatives.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site.

A review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

AROD Data Certification

The following information is included in the Decision Summary section of the AROD. Additional information can be found in the AR file for this Site.

- Current and future land use (page 19)
- Chemicals of concern (COCs) and their respective concentrations (pages 20)
- Baseline risk represented by the COCs (pages 20-27)
- Cleanup levels established for COCs and the basis for the levels (pages 28- 29)
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (pages 39 - 41)
- Decisive factors that led to selecting the remedy (pages 42 - 43)

Beverly D Banister, Acting Director
Waste Management Division

9-21-06
Date

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**AMENDED
RECORD OF DECISION
Sanford Gasification Plant Site
Operable Unit One
DECISION SUMMARY**

INTRODUCTION

This decision document presents the amended selected remedial action for the Sanford Gasification Plant Site ("the Site"), in Sanford, Seminole County, Florida, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This remedy decision is based in the Administrative Record (AR) for the Site. The Florida Department of Environmental Protection (FDEP) agrees with the cleanup approach for this Amended Record of Decision (AROD) and its concurrence is anticipated. This AROD will become part of the AR file pursuant to NCP Section 300.825(a)(2).

On July 5, 2000, the Environmental Protection Agency (EPA) issued a Record of Decision (ROD) for Operable Unit One (OU1). The OU1 ROD established the remedial cleanup goals for the soils Chemicals of Concern (COCs) in surface and subsurface soil. The selected remedy for OU1 involved the removal of surface and subsurface soil contamination with off-site thermal treatment and/or disposal in a landfill and groundwater monitoring to verify the effectiveness of the source removal. On June 12, 2001, EPA issued a ROD for OU2 to address the groundwater contamination. The selected remedy for OU2 involved Monitored Natural Attenuation (MNA) and Institutional Controls.

Upon completion of the OU1 ROD, the Potentially Responsible Parties (PRPs), developed a Design Sampling and Analysis Plan (DSAP) to obtain information for the purpose of implementing the remedial design for the OU1 remedy. The DSAP field activities were conducted from January 2002 through June 2002. The DSAP revealed that the estimated volume of soil exceeding the remedial cleanup goals established in the OU1 ROD would actually be 4.5 times the original estimated quantity identified during the Remedial Investigation (RI). Correspondingly, the extent/volume assumptions utilized in the Feasibility Study (FS), which served as the basis for the OU1 ROD, were no longer accurate. The initial estimated volume of surface and subsurface soil impacts of 22,600 cubic yards (cy) was increased to approximately 104,641 cy as the result of the DSAP data.

The OU1 soils impacted area was initially defined as the former Sanford Gasification Plant (SGP) facility, the unnamed tributary, and the confluence of the unnamed tributary with Cloud Branch Creek. However, the DSAP activities and sampling results indicated that impacted surface and subsurface soils actually extend north of the confluence with Cloud Branch Creek up to south of West 3rd Street, and east and west further into portions of Christian Prisons Ministries.

(CPM), Armand Enterprises, Inc., Codisco and CSX properties .

In 2002, EPA instructed the PRPs to prepare a Remedial Alternatives Evaluation Report (RAER) based on DSAP data to evaluate whether the previous OU1 selected remedy remained the most appropriate for the Site. After evaluating the alternatives presented in the RAER, EPA determined that an amendment to the original remedy was necessary to address the volume increase and the extent of soil contamination. In this regard, the significant change in volume and cost requires an amendment to the original OU1 ROD, issued on July 5, 2000, in accordance with CERCLA Section 117 and NCP Section 300.435(c)(2)(ii). To reflect the change in remedy, this AROD incorporates a combination of technologies. After careful consideration of the various alternatives presented in the RAER, EPA selected a combination of In-Situ Solidification/Stabilization (ISS), off-site disposal and optional use of Chemical Oxidation in non- Nonaqueous Phase Liquid (non-NAPL) areas.

In addition to the above-referenced findings during the DSAP sampling activities, results also indicated the presence of other contaminants on adjacent properties which may not be attributable to Manufactured Gasification Plant (MGP) releases. This finding was the subject of many discussions between EPA and FDEP. An approach to addressing this issue was developed between the Agencies and is discussed further throughout this document.

DECISION SUMMARY

1.0 SITE LOCATION AND DESCRIPTION

The CERCLIS identification number for this Site is FLD984169193.

The former SGP facility was located on the north and south sides of West 6th Street between Holly Avenue and the former Cedar Avenue in Sanford, Seminole County, Florida. The former SGP facility was located adjacent to an unnamed tributary (stream) which intermittently flows to Cloud Branch Creek. From that point, Cloud Branch Creek flows northward for approximately one half miles to Lake Monroe. Bordering the former facility to the north and northwest are properties currently owned by CSX and the City of Sanford. The Site, as defined by CERCLA, includes the former SGP facility, the unnamed tributary and Cloud Branch Creek from the unnamed tributary to where it discharges into Lake Monroe. The Site is located within a combination of residential, commercial and industrial district of Sanford (Figure 1). Currently, a significant portion of the property upon which the former SGP facility was located, is owned by the Florida Public Utilities Company ("FPUC") (Figure 2). FPUC formerly maintained an office and natural/propane gas distribution center at that location until 2002 when the operations were relocated.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Site History

Historically, the SGP was operated from the 1880's to approximately 1951. From the 1880's until 1951, water gas and carbureted water gas were manufactured at the SGP by carbonization or destructive distillation of bituminous coal and coke. Through the manufacturing process, gas holder tanks were used to store waste tars and condensates, frequently leaked resulting in contamination.

The SGP was owned and operated by Sanford Light and Fuel Company from the 1890's until 1914. From 1914 to 1924, the SGP was owned and operated by Southern Utilities Company. From 1924 until 1928, the City of Sanford owned and operated the SGP. From 1928 until 1932, the City of Sanford owned the SGP, but was operated by the Sanford Gas Company. In 1932, the Sanford Gas Company acquired the title to the SGP and continued operating until 1944, at which time Sanford Gas Company merged with Florida Power Corporation. Florida Power Corporation owned the Site and continued to operate the SGP until 1946, at which time the SGP was transferred to South Atlantic Gas Company. South Atlantic Gas Company owned and operated the SGP from 1946 to 1949. In 1949, title to the SGP was transferred to Florida Home Gas Company, which continued operating the SGP until approximately 1951, at which time gas manufacturing ceased. Florida Home Gas Company owned the property from 1949 to 1954, at which time it transferred the property title to the Sanford Gas Company. In 1965, the Sanford Gas Company transferred property title to FPUC, which has owned a portion of the former SGP to date. Two parcels, south of West 6th Street and east of FPUC's property, owned by Armand Enterprises, Inc., are also a part of the former SGP facility.

Based on the current and past ownership/operation of the former plant and property, several parties have undertaken actions relating to environmental concerns at the Site. These parties are the PRPs which make up the Sanford Gasification Plant Site Group (hereinafter "the Sanford PRP Group"). The Sanford PRP Group includes Florida Power Corporation, Atlanta Gas Light Company, Florida Power & Light Company, FPUC and the City of Sanford. In 1991, 1992 and 1993, the Sanford PRP Group conducted soil, groundwater, and sediment sampling to delineate the extent of impacts at the Site as provided in an investigation plan approved by FDEP. The results of the investigation were presented in a report provided to FDEP in 1993.

EPA, FDEP and the PRPs have conducted separate environmental investigations at the Site to determine potential impacts to soil, groundwater, surface water and sediments from operations of the former gasification plant.

On July 11, 1997, EPA issued Special Notice Letters to the Sanford PRP Group. The Special Notice Letters identified these parties as the PRPs for the Site and requested that they perform a Remedial Investigation/Feasibility Study (RI/FS) to characterize the nature and extent of contamination for purposes of remedy selection.

In April 1998, the Sanford PRP Group and EPA executed an Administrative Order on Consent (AOC) to conduct the RI/FS. In August 1998, the Sanford PRP Group submitted the final Work Plan. Field work on the Site began in October 1998. Two new addendums to the original Work Plan were incorporated to accommodate new samples. First, an addendum was made to include samples at an area of contamination located at the City of Sanford Water Treatment Plant. Second, an addendum was made to include a collection of background samples at the Pebble Junction Property.

In April 1999, EPA focused the cleanup efforts for the Site into three (3) phases or Operable Units (OUs). EPA prioritized its actions on the Site beginning with the impacted soils first, groundwater second and sediments in the Cloud Branch Creek and the delta in Lake Monroe third.

The Feasibility Studies (FSs) for OU1 and OU2 were completed on January 20, 2000 and September 28, 2000, respectively. The FSs were developed based on previous investigations, RI data, the Human Baseline Risk Assessment (BRA) and Step 1 through Step 3 of the Ecological Risk Assessment (ERA) for soils. EPA issued the OU1 ROD on July 5, 2000 and OU2 ROD on June 12, 2001. The OU1 ROD stipulates the remedial cleanup goals for COCs in surface and subsurface soils. The remedy selected for OU1 involved the removal of impacted surface and subsurface soils with off-site Thermal Treatment and/or disposal in a landfill, and groundwater monitoring to verify the effectiveness of the source removal. Surface soil remedial cleanup goals were selected based on human health exposure risk factors and subsurface soil remedial cleanup goals were selected based on concerns regarding COCs leaching to groundwater. The OU2 ROD, which addressed the groundwater contamination, stipulates the selected remedy as MNA of COCs to drinking water standards.

Based on the selected OU1 remedy, the Sanford PRP Group, developed a DSAP to collect data to be used as part of the OU1 remedial design. Field activities lasted from January 2002 to June 2002.

2.2 Enforcement Activities

Preliminary Assessment

In March 1990, FDEP conducted a Preliminary Assessment (PA) to assess the potential for environmental impacts at the former SGP and to make recommendations regarding the need for further action under CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The investigation involved a review of background information and existing state regulatory files relating to the former SGP. A "windshield survey" was also performed to confirm the location and physical appearance of the Site. The PA document provides a general overview of the site history, typical MGP production practices, and common contaminants found at gasification plant sites. FDEP recommended that a Site Screening Investigation (SSI) be performed on Site and along the adjacent drainage ditch and the nearby Cloud Branch Creek.

Site Screening Investigation

In June 1991, Ecology and Environment, Inc. (E&E) produced a report for a Site Screening Investigation (SSI) for FDEP from a field work event conducted on Fall 1990. The study consisted of background information and FDEP file review, two days of site reconnaissance, and a limited sampling event. The results of E&E's investigation indicate that historic activities, namely generation of coal tar wastes and possible tar sludges at the Site, have released contaminants to the on-site soil and groundwater. The results indicated the potential for contamination of surface water and/or sediments via surface runoff. The SSI concluded that it was evident that soil and groundwater contamination at the Site with respect to polycyclic aromatic hydrocarbons (PAHs), metals, and total recoverable petroleum hydrocarbons were attributable to coal tar and/or tar sludge sources, from the location of the former tar well. Also, the report concluded that a more in-depth investigation to delineate the nature and extent of the contamination at the Site was necessary.

Soil Boring Investigation

In 1990, PRP, FPUC, the current owner of a portion of the Site, contracted with Environmental Consulting & Technology, Inc. (ECT) to perform a soil boring investigation to better delineate vertical and horizontal extent of soil impacts at the Site. Using a predefined soil boring grid, a series of 49 soil-hollow stem auger borings were advanced at selected points. Borings were advanced to a depth of 15 ft to 20 ft. Split-spoon soil samples were collected to better delineate the vertical extent. ECT stated in its report that tar was observed in 27 of the 49 borings.

Preliminary Investigation of Surface Soils and Sediments

In 1991, PRP, City of Sanford, contracted ECT to investigate surface soils and sediments associated with the Cloud Branch Creek drainage system between West 6th and West 1st Streets. A total of 29 shallow (approximately 1-foot depth) hand augers borings were completed in the study area, with soil/sediment samples inspected for visible tar. Nine borings were completed along the length of the tributary and surrounding drainage basin. In addition to a visual inspection, the nine tributary borings were also sampled and analyzed with an organic vapor analyzer (OVA). A series of random borings were also made along Cloud Branch Creek, from West 6th Street to West 1st Street. No analyses for PAHs or volatile organic compounds (VOCs) were performed.

Preliminary Investigation of Groundwater

Atlanta Gas Light Company and FPUC installed five monitoring wells on and adjacent to the Site in June 1992. Three shallow monitoring wells were screened at the water table and two deeper wells were screened immediately below the shallowest confining unit. The groundwater from these wells was sampled and analyzed for VOCs and base neutral acid compounds.

Contamination Assessment

Atlantic Environmental Services, Inc. and Leggette, Brashears, & Graham, Inc. conducted contamination assessment (CA) field activities in 1993 for the Sanford PRP Group. The CA included a well survey, soil gas survey, installation of nine monitoring wells, sampling of 14 monitoring wells, collection of eight surface soil samples, collection of two surface sediment samples, collection of four surface water samples, collection of 11 subsurface soil samples, 27 soil borings, a total of nine transects subsurface soil samples along Cloud Branch Creek, and five slug tests in five of the monitoring wells to evaluate hydraulic conductivity.

A review of the St. Johns River Water Management District water well construction permits and the water well and consumptive use permit inventory did not identify any water-supply wells within 0.5 miles of the Site.

Impacts related to operations of the former plant were found in on-site groundwater and soil, groundwater north of the Site, sediment from the unnamed tributary and Cloud Branch Creek, and soil along the unnamed tributary and Cloud Branch Creek.

Expanded Site Inspection

In June and July 1996, EPA conducted an Expanded Site Investigation (ESI). The ESI included the collection of thirty-four (34) surface soil samples, fourteen (14) subsurface soil samples, thirty-five (35) sediment samples, twenty-one (21) surface water samples, installation of seven (7) permanent wells and six (6) temporary wells, and a geophysical survey. The ESI report confirmed results from previous investigations. Data from the ESI report and previous investigations were used to prepare the Hazardous Ranking System Package in order to propose the Site for listing on the National Priorities List (NPL). Even though, the Site was determined to be of NPL caliber and the ranking package was completed, the Site was not listed on the NPL. The Sanford PRP Group negotiated with EPA to exclude the Site from listing in exchange for voluntarily conducting the investigation and cleanup activities.

Remedial Investigation

GEI Consultants, Inc., working on behalf of the Sanford PRP Group, completed the Remedial Investigation on July 29, 1999. As a part of this investigation, GEI Consultants collected 133 samples of the soil, groundwater, and sediments and analyzed the samples for metals, cyanide, volatile compounds (i.e., benzene, toluene and xylene), and semi-volatile compounds (i.e., PAHs). Sample locations included the former SGP, the unnamed tributary, Cloud Branch Creek, and the Cloud Branch Creek outfall in Lake Monroe.

Results from the investigation revealed that source material consisting of tar-saturated soil or sediments, coal/coke, black-stained soil, or sediments with a strong naphthalene odor were identified at some locations extending from land surface to the top of the confining unit (approximately 30 ft) on Site and along the unnamed tributary up to Cloud Branch Creek [approximately at depths up to 30 ft below land surface (bls)]. Source material in sediments along Cloud Branch Creek from the unnamed tributary to Mill Creek exists at various locations

from the sediment water interface to a depth of 4ft. Tar saturated Nonaqueous Phase Liquid (NAPL) has been identified in soil near the confluence of Cloud Branch Creek and the unnamed tributary. NAPL has also been identified in a thin shell hash layer near the confluence of Cloud Branch Creek and Mill Creek. The NAPL present at the confluence of Cloud Branch Creek and the unnamed tributary is associated with overlying tar-saturated material at the same locations. The NAPL detected in the shell hash at the confluence of Cloud Branch Creek and Mill Creek is isolated in the thin shell hash layer at 20.5 ft bls.

Remedial Design Sampling

Based on the selected remedy for the OUI ROD and discussions with EPA, the Sanford PRP Group developed a DSAP to collect data to provide information for use in the preliminary design of the OUI remedy. The DSAP field activities were conducted from January 2002 through June 2002. During the DSAP field activities the estimated volume of soil exceeding the remedial cleanup goals established in the OUI ROD increased by approximately 4.5 times the original estimated volume in the RI.

There were three primary components to the DSAP field investigation: environmental, geotechnical and hydrogeologic data collection. The objective of the environmental investigation was to establish the horizontal and vertical limits of the soil that exceeds the surface and subsurface soil remedial cleanup goals specified in the OUI ROD. The objective of the geotechnical and hydrogeologic investigations was to acquire data to support the evaluation and design of future remedial actions.

The surface soil samples were collected at 43 locations, initially, for a total of 86 samples (two soil samples at each location), to determine the volume of surface soil that exceeded the surface soil cleanup level. COCs were detected at concentrations above remedial cleanup goals in surface soil samples at 30 locations. Further, 62 additional surface soil samples were collected at 31 "step-out" locations. The step-out locations were located between 10 and 30 ft from the initial sample location. COCs were detected above the remedial cleanup goals at 22 step-out surface soil sample locations, and at some of the step-out locations COCs were significantly higher than the initial sample location.

A total of 618 subsurface soil samples were collected at 240 environmental boring locations to determine the volume of subsurface soil that exceeded the subsurface soil remedial cleanup goals. Subsurface soil borings were collected in a grid pattern of 30 ft by 30 ft. A step-out approach was used, as defined in the DSAP, to delineate the horizontal and vertical extent of subsurface soil impacts. The subsurface soil sampling and boring activities revealed visual and analytical subsurface impacts extending from the southern boundary of the former SGP north to the West 3rd Street right-of-way (ROW). The visual impacts noted north of the confluence of Cloud Branch Creek and the unnamed tributary had not been identified prior to implementing the DSAP fieldwork.

The geotechnical investigation included field exploration and a laboratory testing program. The primary objective of the field sampling work was to advance a series of the test borings located near but outside the periphery of impacts to allow for visual inspection of soils and performance

of field testing. Thirteen borings were drilled to depths of approximately 66 ft to 80 ft bls. The field data collected included blow counts, visual characterization, vane shear, torvane and pocket penetrometer. Four distinct geologic layers were encountered during the geotechnical investigation: shallow sand and shell, clay, deep sand and shell, and limestone. The shallow sand and shell unit consists of the overburden material extending from land surface to top of clay. The thickness of the shallow sand and shell ranges from approximately 20.3 ft to 42 ft. Clay underlies the shallow sand and shell and varies in thickness from approximately 1.6 ft to 18.3 ft. Beneath the clay is the limestone, present below the deep sand and shell and ranges in depth from approximately 65 ft to 71 ft.

The primary objective of the geotechnical laboratory testing program was to further define the engineering properties of the site-area soil. The thin-wall tube samples and soil samples obtained from split-spoons were analyzed for grain size distribution, Atterberg limits, specific gravity, calcium carbonate content, and comprehensive strength.

Hydrogeology data collected during the DSAP investigation was used to estimate the hydraulic conductivity of the shallow and intermediate aquifers and to evaluate the vertical gradients and the hydrogeologic connection between the shallow, intermediate and deep aquifers. Two aquifers tests were performed in the shallow aquifer and one in the intermediate aquifer.

A long term aquifer test was conducted at a pumping well screened below the clay confining unit in the intermediate aquifer, within clayey shell and sand zones. The pumping well was installed outside the area of overlying impacted soil and groundwater.

DSAP sampling analysis results indicated an increase of certain COCs toward the borderline of CSX properties north and south of West 6th Street. Arsenic was noted to increase toward the old railroad lines.

In an effort to evaluate levels of COCs in surface soils that may be a result of other historical and current industrial and urban sources, the Sanford PRP Group collected 19 control surface soil samples from City of Sanford property ROWs in areas surrounding the Site (450 to 2,000 ft). Six of the off-site control sample locations had one or more COCs (specially polycyclic aromatic hydrocarbons [PAHs]) exceeding the OUI surface soil cleanup goal.

As an unbiased effort EPA collected samples, in two separate events, from the neighboring property owned by CSX. Sample results showed a pattern of arsenic and PAHs increasing toward old railroad lines, which confirmed the Sanford PRP Group assessment of the DSAP sampling results.

In addition, in a separate event, EPA collected 10 control samples from locations around the City of Sanford. Some of the samples were collected from Sanford city parks. Samples were analyzed for arsenic, lead and PAHs.

3.0 SCOPE AND ROLE OF AMENDED RECORD OF DECISION

The planned action for OU1 (soils) for this Site addresses surface soil and subsurface contamination. Since the OU2 ROD addresses the groundwater remedy, therefore, a groundwater component will not be included as part of this AROD. However, groundwater contamination mitigation will likely occur because the subsurface soil will be cleaned up to insure future protection of groundwater to drinking water standards. Additional well construction and groundwater monitoring plan are being addressed as part of the OU2 remedy selection. The selected groundwater remedy will not be affected by this AROD.

In addition to the groundwater OU2 ROD, an Operable Unit Three (OU3) ROD is anticipated to address the contaminated sediments in Cloud Branch Creek from the confluence with the unnamed tributary to the delta with Lake Monroe.

The remedy previously selected for the OU1 ROD included:

- a. Removal of the upper 2 feet of soil to risk-based levels and removal of subsurface soil "hot spots" to insure the future protection of groundwater. The excavated soil would then be classified for waste disposal and transferred to an off-site facility to be thermally treated and/or disposed or if determined to be characteristic of hazardous waste disposed off at a RCRA Subtitle Class C Facility;
- b. Use of measures to reduce the potential of fugitive dust emissions the and impacts from transporting impacted soil through the community during the excavation;
- c. Use of groundwater dewatering system and an excavation support system below the groundwater table during excavation; and
- d. Groundwater monitoring for 10 years to verify the protectiveness of the subsurface excavation.

The remedy previously selected for OU1 was not implemented due to results obtained during the DSAP. The DSAP indicated the actual soil volume which needed to be addressed was approximately 4.5 times the original estimated quantity. This volume increase led to a cost increase as well.

The proposed amendment to the selected remedy considers the following:

- a. the potential additional risk due to the increase in soils needing to be managed in order to conduct the soil excavation and off-site disposal required under the previously selected remedy;

- b. concerns with the integrity of the clay hydrological barrier above the intermediate aquifer once the contaminated surficial aquifer soil is removed through excavation;
- c. cost increase and cost effectiveness associated with the cleanup of the additional contaminated soils needed to be addressed in order to satisfy the remedial cleanup goals established for surface and subsurface soil COCs; and
- d. issues with the extent of the surface cleanup line with regards to arsenic and PAHs and other attributable sources.

This AROD addresses the soils cleanup of PAHs and other contaminants mostly believed to be from the Site. Contact with contaminants at the Site poses an unacceptable risk to human health because EPA's target risk range is exceeded and concentrations are above Applicable or Relevant and Appropriate Requirements (ARARs) within the boundary of attributable MGP wastes. The purpose of this AROD is to prevent current and/or future exposure to COCs at concentrations that pose an unacceptable risk and to reduce the source of impacts to the groundwater.

4.0 HISTORY OF COMMUNITY RELATIONS

To date, three (3) Open House Meetings and three (3) Proposed Plan Meetings have taken place at the West Sanford Boys and Girls Club. The first meeting was held on September 23, 1998, to inform the community of the status of the enforcement action and to announce the upcoming sampling event for the RI. Community interviews were conducted with local officials and residents in September 1998. Using information collected during these interviews, EPA developed a community relations plan to address the concerns and information needs of the community. It also identifies opportunities for the community to take part in cleanup decisions about the Site and the opportunity to form a Community Advisory Group (CAG). A second meeting was held on May 12, 1999, for the purpose of informing the community about the steps to form a CAG. A third meeting was held on September 22, 1999, to inform the community about the results of the RI. Additional Proposed Plan Meetings have been held for on April 18, 2000 and February 7, 2001, for OU1 and OU2 respectively. The most recent Proposed Plan meeting was held on June 7, 2006, to present to the community EPA's preferred alternatives for the amended cleanup action of the soil contamination at the Site and the sediments at the Cloud Branch Creek related to Site contamination.

Fact Sheets for the Site have been issued in September 1998, September 1999, April 2000 and January 2001. The most recent Proposed Plan Fact Sheet for the OU1 AROD and the OU3 ROD was issued on May 19, 2006. The comment period for the Proposed Plan started on May 24, 2006 and ended on June 24, 2006. No comments from the community were received during the comment period.

On April 13, 2006, representatives from EPA, FDEP and the Sanford PRP Group met informally with property owners that could be affected by Site remediation activities around the OU1 and OU3 areas to discuss findings and possible remedies. The property owners affected by the remediation of the Cloud Branch Creek voiced a preference to culvert the creek. The concerns were taken into consideration when making the final OU3 remedy selection.

On June 7, 2006, EPA presented its amended preferred remedy for the OU1 and the remedy for OU3 during a public meeting. A transcript of that meeting is available at the Site information repositories. Another public meeting was scheduled and announced for June 8, 2006, however, it was cancelled due to lack of public attendance.

The AR has been updated to include documents used as the basis for this amended remedy selection at the Site in accordance with Section 300.825(a)(2) of the NCP. The final EPA approved AROD, the Responsiveness Summary and the transcript of the public meeting will also be included as part of the AR. The AR is available for public review and copying in the Site information repositories, located at EPA Region 4 in Atlanta, GA and at the North Branch Library, 150 North Palmetto Avenue, downtown Sanford.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Geology

Environmental and geotechnical soil borings completed at the Site during the DSAP field event were used to refine the current understanding of the Site geology. The shallow stratigraphy of the Site consists of five main units identified as: 1) sand with debris; 2) fine sand with varying amounts of silt and clay; 3) shell with fine sand; 4) fine sand with clay and shell; and 5) clay.

The sand with debris unit is typically dry and consists of gravel, coarse to fine sand, and varying amounts of brick, glass, metal, concrete rubble, wood, and clinker. Where present, the sand with debris unit extends from land surface to a maximum depth of approximately 12 ft bls.

A fine sand unit underlies the sand with debris unit and is generally present between 4 ft bls and 20 ft bls. The fine sand unit is described as fine sand with varying amounts of silt and clay, and is saturated. The fine sand unit consists of discontinuous layers of dense fine sand with clay and isolated clay lenses.

A shell with fine sand (referred as a "shell") unit underlies the fine sand unit north of West 5th Street ROW. Where present, the average depth to the top of the shell unit is 18 ft bls, and the average depth of the bottom of the shell unit is 24 ft bls. The shell unit consists of shell with trace amounts to some fine-grained soil consisting of fine sand, silt and/or clay and is saturated. The most severe MGP-related impacts appeared to be concentrated in the shell unit most likely due to its permeability. The shell unit appears to be thickest in the vicinity of the Cloud Branch Creek channel. Where present, the thickness of the shell unit ranges from 0.1 ft to 18 ft, with an average thickness of approximately 6 ft.

Thin, discontinuous layers of fine sand with clay and little to some shell are present below the fine sand unit south of the West 5th Street ROW and above and below the shell unit north of the West 5th Street ROW.

A clay unit underlies the fine sand unit, shell unit, and fine sand with clay and shell unit. The top of the clay unit ranges from 18.1 ft bls to 45.6 ft bls. The clay layer contains little amounts of fine sand, silt, and/or shell. It is very soft to very stiff (stiffness increases with depth) with a high plasticity, and is moist. Discontinuous lenses of sand and clay with shell were encountered with the clay unit. The visual observations of the NAPL on top of the clay unit and not within the clay suggests that the clay unit is confining to vertical Dense Nonaqueous Phase Liquid (DNAPL) migration. The clay unit ranges in thickness from 1.6 ft to 18.3 ft at the Site.

The surface of the clay unit is comparatively low at the following locations:

- along the southern side of West 6th Street, south-southeast of the vacant FPUC office building;

- south of West 6th Street in the western portion of the Site;
- west of Cedar Avenue ROW, south of the unnamed tributary, and northwest of the vacant FPUC office building;
- along Cedar Avenue ROW, north/northwest of the vacant FPUC office building; and
- along the Cedar Avenue ROW, east of the culvert in the unnamed tributary.

In general, the top of the clay surface appears to slope away from the unnamed tributary and Cloud Branch Creek channels.

MGP impacts were observed at the top of the clay unit beginning just south of the unnamed tributary and Cloud Branch Creek confluence and appear to have migrated through the more permeable shell unit and along the top of the clay unit northward to West 3rd Street.

5.2 Hydrogeology

Three hydrogeologic units are located in the site vicinity: the Surficial, the Intermediate, and the Floridan aquifer systems. In Seminole County, the Surficial System is composed of Pleistocene to recent age fine to coarse-grained quartz sands. In Seminole County, the Surficial aquifer is an unconfined aquifer that typically ranges between 10 and 75 feet in thickness. The Surficial aquifer is primarily recharged by the direct infiltration of rainfall. Across Seminole County, water levels in the Surficial aquifer vary between land surface and 40 feet below ground surface. Naturally occurring iron concentrations in groundwater from the Surficial aquifer limits its use to primarily lawn irrigation, and less frequently domestic and livestock applications.

The Surficial aquifer is underlain by the Intermediate system, which consists of the blue clay and shell beds of differentiated Pliocene to Miocene-age deposits and the blue-to-gray, calcareous clays and interbedded cream to gray, sandy limestone of Miocene-age Hawthorn Group. Locally, the sandy limestone within the Intermediate System may be capable of yielding significant quantities of water. However, the low-permeability clay units within the Intermediate system separate the Surficial and the Floridan aquifers. The Intermediate system is present throughout most of Seminole County with a thickness of approximately 150 feet. However, in the northern part of the county, along the St. John's River and Lake Monroe, the intermediate deposits have been eroded.

The Intermediate system is underlain by the Eocene-age carbonate units of the karstic Floridan aquifer. The Floridan aquifer includes cream-to-tanish gray, soft-to-hard, granular porous, marine limestones of the Ocala Group (which may be absent in the northern part of Seminole County); the light gray-to-brown, porous-to-dense, granular-to-chalky limestones of the Avon Park Limestone; and the alternating layers of hard, brown, porous crystalline dolomites and hard, cream-to-tan, chalky limestone/dolomitic limestones of the Lake City Limestone. The top of the Floridan aquifer generally occurs at depths of between 74 and 85 feet bls in the Site vicinity.

Groundwater in the Floridan aquifer exists under artesian conditions. Given that the Floridan aquifer potentiometric surface is similar to the Surficial aquifer water level elevations noted in

the vicinity, downward leakage from the Surficial aquifer would not be expected.

Hydrogeology data collected during the DSAP investigation was used to estimate the hydraulic conductivity of the shallow and intermediate aquifers and to evaluate the vertical gradients and the hydrogeologic connection between the shallow, intermediate and deep aquifers. Several aquifer tests were conducted to evaluate hydrogeologic properties of the impacted units as well as the water bearing units below impacts for future remedial design purposes. Short term aquifer tests were conducted at two monitoring wells screened above the top of the clay confining unit and located within the area of the former SGP impacted soils.

The shallow aquifer is within the shallow and fine sand and shell encountered at the Site from land surface to generally 30 ft bls. The groundwater table ranges from a depth of 1 ft to 10 ft bls. Groundwater elevations measured in December 1998 and June 1999, in the vicinity of the confluence of Cloud Branch Creek and Mill Creek illustrated that groundwater flow is toward the creeks. A clay unit underlies the shallow aquifer and has been encountered between approximately 18 and 46 ft bls.

The estimated horizontal hydraulic conductivity of the fine sand unit at well location MW-3D ranged from 2.7 ft per day to 36 ft per day. The estimated horizontal hydraulic conductivity of fine sand and shell at well location MW-12 I ranged from 15 ft per day to 190 ft per day. The estimated hydraulic conductivity of the intermediate aquifer ranged from 1.5 ft per day to 4.4 ft per day.

Groundwater in the area of the former facility is not used as a drinking water source. No surficial aquifer system drinking water wells have been documented within four (4) mile radius of the Site. The Floridan aquifer is the principal source of potable water in the Sanford area. The City of Sanford Utility Department provides potable water with water obtained from wells located between 3 and 4 miles upgradient from the Site.

5.3 Soil Contamination

The majority of the former plant structures were removed prior to 1962, and no above ground structures containing plant related residuals exists today. Previous investigations confirmed that no subsurface structures containing source materials are present today. However, source material has been identified during the investigations as tar-saturated soil or sediment (including sheen), coal/coke, and black stained soil or sediment with strong naphthalene odor. These source materials have been identified in soil on-site, soil and sediment along Cloud Branch Creek, and sediments along Cloud Branch Creek downgradient of the confluence with the unnamed tributary.

Tar-saturated or stained soil was found on Site and along the unnamed tributary to the confluence with Cloud Branch Creek extending in some areas from land surface to the top of the clay layer (confining unit) at a depth of approximately 30 ft bls. Source material in sediments along Cloud Branch Creek exists from the sediment water interface up to a depth of at least 4 ft.

5.3.1 Surface Soil Contamination

As agreed between EPA and the Sanford PRP Group, due to the nature of the unnamed tributary, which intermittently flows to Cloud Branch Creek, the sediment samples collected from the unnamed tributary during the CA and the ESI were evaluated as surface soil samples.

During the RI sampling, surface soil samples from the Site were collected along the unnamed tributary, around the confluence of the unnamed tributary and Cloud Branch Creek, and upgradient of the Site.

Benzene, toluene, ethylbenzene, and xylene (BTEX) were detected in one surface soil sample, a control sample, during the ESI. Surficial PAHs have generally been delineated along the FPUC property south and north of West 6th Street. However, relatively elevated levels of PAHs were detected west of FPUC office, and to the east, west, and north of the toe area (area where Cloud Branch Creek and the unnamed tributary merge).

VOCs were not detected in surface soil samples except in one sample at very low concentrations.

Based on the data from the Contamination Assessment Report (CAR) and the ESI, the eight RCRA metals (arsenic, cadmium, chromium, lead, mercury, silver, barium and selenium) and copper, iron, manganese and zinc were the only metals proposed to be analyzed during the RI. These metals were selected for monitoring because these metals are recognized for being potentially related to MGP process, and a significant number of soil samples collected during the ESI and CAR had concentrations of the proposed metals exceeding Region 4's screening values. The CAR, ESI and RI metal data for surface soil were evaluated by comparing the results with Region 4 screening criteria (Region 3 Risk Based Concentration (RBC) Table Residential values). The Contaminants of Potential Concern (COPCs) for surface soils, derived during the risk assessment process and based on data available up to the RI stage, are presented in Table 1. RI surface soil sample locations can be found in Figure 3.

During the DSAP investigation surface soil samples were collected at 43 locations, initially, for a total of 86 samples (two soil samples at each location), to determine the volume of surface soil that exceeded the surface soil cleanup. Surface soil sample locations for the DSAP can be found in Figure 4. Samples were analyzed for PAHs, dibenzofuran, antimony, arsenic, and iron; contaminants that were determined through the Baseline Risk Assessment to be the COCs for the OU1 soil cleanup. COCs were detected at concentrations above remedial cleanup goals in surface soil samples at 30 locations. Further, 62 additional surface soil samples were collected at 31 "step-out" locations. The step-out locations were located between 10 and 30 ft from the initial sample location. At 22 step-out surface soil samples locations certain COCs were detected above the cleanup goal and some COCs were detected in concentrations significantly higher than the initial sample location. DSAP sampling analysis results indicated the increase of those COCs toward the borderline of CSX properties north and south of West 6th Street. Arsenic was noted to increase toward the approach of CSX old railroad lines. Figure 5 illustrates sample locations for the highest arsenic sampling results.

In an effort to evaluate levels of COCs in surface soils that may be a result of other historical and current industrial and urban sources, the Sanford PRP Group collected 9 control surface soil

samples from City of Sanford property ROWs in areas surrounding the Site (450 to 2,000 ft from the SGP). Six of the off-site control sample locations had one or more COCs (specifically polycyclic aromatic hydrocarbons [PAHs]) exceeding the OU1 surface soil remedial cleanup goals. Sampling results can be found in Table 2. Figure 6 illustrates sample locations for Table 2.

As an unbiased effort EPA collected samples, in two separate events, from the neighboring property owned by CSX. Sample results showed a pattern of arsenic and PAHs increasing toward old railroad lines. These results confirmed the Sanford PRP Group's assessment of the DSAP sampling results, which indicated the increase of those COCs toward CSX borderline properties. Figure 5 illustrates the highest arsenic concentrations found, including the Sanford PRP Group and EPA's data, collected to date. Table 3 includes the sample results represented in Figure 5.

In addition, in two separate sampling events, EPA collected background/control samples from locations around the City of Sanford. Some of the samples were collected from Sanford City parks. Samples were analyzed for arsenic, lead and PAHs. EPA sample locations are included in Figure 7. EPA sample results can be found in Tables 4 and 5.

EPA and FDEP assessed the situation and determined that the best way to address the situation was to establish Site boundaries based on attributable MGP related contaminants and data analysis trends between the former SGP facility and CSX property. Figure 8 titled "Generalized Concentration Gradient" presents the trend of arsenic as approaching the old CSX railroad lines.

The estimated area of surface soil impacts is presented on Figure 9. Details of sampling location and results are presented in the DSAP report. The surface soil analytical results were compared to residential risk-based levels.

5.3.2 Subsurface Soil Contamination

During the RI sampling, subsurface soil samples were collected from 15 boring locations, primarily in connection with the installation of the monitoring wells.

The highest concentrations of BTEX and PAHs detected at the former facility were in the subsurface soil samples collected from areas where tar and/or NAPL were observed.

The analytical data generated during the RI confirmed the horizontal and vertical extent of subsurface soil impacts observed in previous to the RI investigations. Subsurface soil sample locations collected during the RI can be found in Figure 10.

None of the metals detected in on-site subsurface soil samples exceeded Region 4's screening criteria. Arsenic, iron and lead were the only metals detected in off-site subsurface soil samples above the screening criteria during the RI. Subsurface soil COPCs, derived during the risk assessment process and based on data collected up to the RI, are presented in Table 6.

During the DSAP investigation 618 subsurface soil samples were collected at 240 boring locations and analyzed for benzene, ethylbenzene, xylenes and naphthalene. Figure 11 illustrates

DSAP subsurface soil sample locations. The horizontal and vertical extent of subsurface soil impacts are presented in the DSAP report. Figure 9 illustrates a top view of the extent of subsurface soil impacts. Analytical results were compared to groundwater protection levels established in the OU2 ROD. In general, relatively shallow (generally less than 15 ft bls) visible impacts and analytical exceedances are present within the sand within debris and fine sand unit in the southern portion of the site. The shallow visible impacts in the southern portion of the Site generally consisted of sheen and residual product. Deeper visible impacts and analytical exceedances are present within the fine sand, fine sand with clay and shell, and shell units extending to the top of the clay (generally encountered between 20 and 30 ft bls) in the central and northern portions of the Site (from approximately the West 5th Street ROW north to West 3rd Street). The deep visible impacts observed in the central and northern portions of the Site consisted of sheen, residual products and DNAPL.

MGP impacts do not extend to the top of the clay in the southern portion of the Site where the former SGP facility was located. MGP related impacts were observed at the top of the clay beginning south of the unnamed tributary and Cloud Branch Creek confluence and appear to have migrated through the more permeable shell unit along the top of the clay northward to West 3rd Street. Vertically, visible areas of contamination were generally confined to the strata above the clay and no evidence of MGP related impacts were observed below the clay.

The DSAP sampling results demonstrated that subsurface soil impacts extend further north into Codisco property up to south of West 3rd Street and further east and west into CSX and Codisco properties. Subsurface soil impacts beyond the previously thought line were also found in the east and west boundaries of the former SGP facility.

During the DSAP investigation, two areas were identified at the Site where subsurface soils are not visibly impacted, yet contain concentrations of COCs that exceeded the groundwater protection levels. These two areas are: (1) underneath the CPM basketball court, where remediation of non-visibly impacted soil is necessary from land surface to 17 to 18 ft bls; and (2) north of West 6th Street in the vicinity of boring RD-18 (east of the unnamed tributary), where remediation of non-visibly impacted soil is necessary from 17 to 27 ft bls (Figure 4). These areas are also referred as non-NAPL areas

6.0 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCES USES

Currently, a significant portion of the former SGP facility is owned by the FPUC, which used to maintain an office and natural/propane gas distribution facility, is now vacant. The other portions of the Site are currently owned by the City of Sanford, CSX Transportation, Armand Enterprises, CPM and Codisco Inc. CPM operates a drug rehabilitation center and Codisco sub-leases two of their buildings to a maintenance operation.

The Site is zoned as Restricted Industrial (RI-1) and General Commercial (GC-2). The Restricted Industrial designation is described as areas which “are intended for light wholesale and manufacturing uses and related accessory use.” The General Commercial (GC-2) designation is described as areas which “accommodate community-oriented retail sales and services; highway-oriented sales and services; and other general commercial activities.” Other adjacent land uses include: multiple family residential, general commercial, and restricted industrial land use.

The surficial aquifer is classified by FDEP as a Class G-II (potable water use). However, groundwater in the area of the former facility is not used as a drinking water source since there is municipal-supplied water. No surficial aquifer system drinking water wells have been documented within a four mile radius of the Site.

To implement the selected remedy, some of Codisco property buildings will have to be demolished. However, the buildings will be re-constructed after the remedy has been implemented, returning the property to beneficial commercial use. The CPM basketball court will be partially demolished as well, however, it will be rebuilt and returned to its original recreational use.

7.0 SUMMARY OF SITE RISK

CERCLA directs EPA to conduct a BRA to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The BRA provides the basis for taking action and indicates the exposure pathways that need to be addressed by the remedial action. This section of the AROD reports the results of the BRA conducted for this Site.

The principal component of the conceptual model for the Site is to assume that surface soil, subsurface soil, sediments and groundwater are contaminated, and that humans could be exposed to contamination through ingestion and/or dermal contact and inhalation in the case of air. The model also studies current and future scenarios for different receptors. The potential noncarcinogenic and carcinogenic risk elements were combined across exposure pathways for each of the media and for each of the potential receptors at the Site as well.

7.1 Contaminants of Concern

The chemicals measured in the various environmental media during the RI were included in the discussion of the site risks, if the results of the risk assessment indicated that a contaminant might pose a significant current or future risk or contribute to a cumulative risk which is significant. To develop the risk assessment and remedial cleanup goals at the Site, EPA first identified the COPCs. The COPCs are chemicals whose data are of sufficient quality for use in the quantitative risk assessment, are potentially site-related, are above background concentrations at the Site, and represent the most significant contaminants in terms of potential toxicity to humans. The COCs are a subset of the COPCs listed in Tables 1 and 6. The criteria for a significant risk was a carcinogenic risk level above 1×10^{-6} or a hazard quotient (HQ) greater than 1.0. Tables 7 and 8 present COCs selected for surface and subsurface soils based on RI data.

The data for samples which represent on-site surface soil are presented in Table B-1 in Appendix B. Analytical data for on-site surface soil were collected to varying degrees during the CAR, the ESI and the RI. For purposes of the BRA, surface soil samples were defined as those taken from depths less than 1 foot bls. This includes samples presented in the RI from a depth of 0-6 inches bls or, alternatively, samples that were identified as surface soil in the CAR and the ESI (depth of 0-1 foot bls). A total of 43 surface soil samples were collected on-site. Chemicals of interest are limited primarily to PAHs and metals. The locations of the on-site surface soil samples are shown in Figure 3 in Appendix B.

The data for samples which represent off-site surface soil are presented in Table B-2 in Appendix B. Analytical data for off-site surface soil were collected during the CAR, the ESI and the RI. A total of 30 surface soil samples were collected off-site. Chemicals of interest are limited primarily to PAHs and metals. The locations of the on-site surfaces soil samples are shown on Figure 3 in Appendix B.

7.2 Exposure Assessment

Regardless of application, all risk assessments have a common basic principle, the concept that complete pathways from environmental release to human exposure must exist, or else human risks are not present. That is, regardless of the intrinsic toxicity of a compound, without plausible exposure scenarios, the compound will not exert its toxic effects. The BRA evaluates in a conservative manner, in accordance with EPA requirements, the potential exposure, and is used as a tool for site-specific decisions.

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure, i.e., whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- A source and mechanism of release from the source;
- A transport medium (e.g., surface water, air) and mechanisms of migration through the medium;
- The presence or potential presence of a receptor at the exposure point; and
- A route of exposure (ingestion, inhalation, dermal absorption).

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change. Exposure by each of these pathways was mathematically modeled using generally conservative assumptions. Residential exposures were evaluated in the BRA. The exposure pathways considered are presented in Table 9.

The various environmental media at the former facility may have been affected by direct historical site disposal practices, by normal facility manufacturing operations and by indirect sources such as soil runoff to surface water or the leaching of contaminants from soil to groundwater.

The exposure points for the BRA are located at either on-site or off-site locations. The exposure routes per EPA practice, are assumed to be combined oral (i.e., ingestion) and dermal routes for surface soil, subsurface soil, groundwater, surface water and sediment, as well as the inhalation pathway for air which may contain volatiles or particulates.

The exposure point concentrations (EPCs) for each of the chemicals of concern and the exposure assumptions for each pathway with an unacceptable risk or hazard were used to estimate the chronic daily intakes for the potentially complete pathways (the exposure assumptions for the pathways of concern can be found in Appendix B). The EPCs are summarized in Tables 10 and 11 for those contaminants and exposure pathways that were found to present a significant

potential risk. The BRA is based on the reasonable maximum exposure (RME) that may be encountered during the various Site use scenarios. The RME concentrations are either the calculated 95% Upper Confidence Limit of the arithmetic mean or the maximum concentration detected during sampling. The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures. If the calculated UCL exceeded the maximum level measured at the Site, then the maximum concentration detected was used to represent the reasonable maximum concentration. The chronic daily intakes were then used in conjunction with cancer slope factors and noncarcinogenic reference doses to evaluate risk.

A. Surface Soil Exposure

Surface soil at a site typically is the most readily accessible environmental medium and, thus, poses the most significant exposure potential. However, the likelihood of actual exposure will be influenced by characteristics such as landscaping, paving and buildings location. Current exposure to on-site or off-site surface soil near the Sanford Site was quantitatively evaluated for a commercial worker scenario and a trespasser/visitor scenario and is presented in Table 9. Future exposure to on-site and off-site surface soil was quantitatively evaluated for a potential resident (child, adult or aggregate), a potential construction worker, and qualitatively evaluated for the commercial worker and the trespasser/visitor, since exposures in the future for these two receptor groups are expected to be equal or less than the current exposure.

B. Subsurface Soil Exposure

The construction worker is the only potential exposed population for direct exposure to subsurface soil (Table 9). Since current construction activities are not occurring or planned at this time, only future exposure of construction workers to any on-site and off-site subsurface soil was quantitatively evaluated. Evaluation of on-site and off-site exposure point concentrations for subsurface soils is presented Tables 12 and 13.

7.3 Toxicity Assessment

Toxicity values are used in conjunction with the results of the exposure assessment to characterize Site risk. EPA has developed critical toxicity values for carcinogens and noncarcinogens. Cancer slope factors (CSFs) have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of $(\text{mg/kg/day})^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day , to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this conservative approach makes underestimation of the actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day , are estimates of lifetime daily exposure levels which pose no

health hazard to humans, including sensitive individuals. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Quantitative dose-response data were compiled from EPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), and National Center for Environmental Assessment (NCEA). Toxicity criteria (RfDs, CSFs) were available for all COPCs except lead. There is no reference dose for lead so the risk characterization was developed by using EPA approved methods for estimating blood lead levels.

The EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model Version 0.99d and the EPA Adult Blood Lead Model are considered applicable at residential and industrial sites, respectively. The IEUBK was used to evaluate on-site surface soil, off-site surface soil and off-site sediments. There is currently no lead exposure model available for surface water, the only other medium in which lead was identified as a COPC. In any event, the maximum detected lead concentration in surface water exceeded the drinking water standard of 15ug/L in only 2 out of 16 samples.

The IEUBK, which was run with the mean detected concentration of lead in on-site surface soil (75 mg/kg), off-site surface soil (74 mg/kg) and off-site sediments (22 mg/kg), did not result in a nominal projected blood level above 10ug/dL for any age group. Based on this analysis, lead was eliminated as a COC for on-site surface soil, off-site surface soil and off-site sediments.

The US EPA Adult Lead Model was used to develop a target lead concentration for off-site subsurface soil, the only case in which childhood exposure is precluded. The Adult Lead Model results in an off-site subsurface soil concentration of 1,067 mg/kg. The applicable receptor for off-site subsurface soil is the pregnant adult construction worker. It should be noted that the construction worker is applicable for on-site surface soil as well.

The methodology and the specific model parameters that were used to calculate the adult, nonresidential human health-based target for lead in off-site subsurface soil was developed by the US EPA Technical Review Workgroup (TRW) for Lead and was presented in the report entitled Recommendation of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. The method is the product of a extensive evaluations by the TRW.

The method used for the adult worker is found in the "Technical Review Workgroup for Lead Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil." The calculations for lead soil levels can be found in Appendix B along with the non-cancer toxicity data and cancer toxicity data.

7.4 Risk Characterization

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. Excessive lifetime cancer risks are determined by multiplying the estimated daily intake level with the CSF. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper boundary, an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the assumed specific exposure conditions at a Site.

EPA considers individual excess cancer risks in the range of 1×10^{-4} to 1×10^{-6} as protective; however, the 1×10^{-6} risk level is generally used as the point of departure for setting remedial cleanup goals at Superfund sites. EPA's definition of acceptable risk is found in 40 CFR 300.430 (e)(2). The point of departure risk level of 1×10^{-6} expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The health-based risk levels for the Site in its current condition are shown in Tables 10.1 through 10.7 in Appendix B.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants' reference dose). An HQ which exceeds unity (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media. The HIs for the Site are shown in Tables 10.1 through 10.7 in Appendix B.

Using the results of the human exposure assessment and the toxicity information, potential human health risks for each COPC and selected exposure pathway were evaluated. Upper bound excess lifetime cancer risks for carcinogenic chemicals and hazard quotients and hazard index values for noncarcinogenic chemicals were estimated. The upper-bound lifetime excess cancer risks derived in this report can be compared to EPA's target risk range for health protectiveness at Superfund sites of 1×10^{-6} to 1×10^{-4} . In addition, the noncarcinogenic hazard indices can be compared to a value of 1 since hazard indices greater than 1 indicate a potential for adverse health effects.

The risk characterization results showed unacceptable risks (i.e., upper-bound excess lifetime cancer risks exceeding the upper limit of EPA's target risk range for health protectiveness at Superfund sites [1×10^{-6}] and/or non-cancer hazard indexes (HIs) greater than one) in surface soil and groundwater. However, it should be noted that exposures to groundwater at the Site are not likely to occur because water is supplied to the area by a municipality.

A summary of potential cancer risk and non-cancer hazard estimates resulting from exposures to Site COCs in surface soil, subsurface soil, surface water, and/or sediment by residents, commercial workers, construction workers, and trespassers/visitors are provided in Appendix B.

7.5 Ecological Risk Assessment

The ERA process establishes the selection of COPCs throughout a series of Steps. Step One included the Site visit and survey to described the Environmental Settings and it is included in the ERA Compendium 1 report. The Screening Level Exposure Estimate (Step 2 of the ERA process) eliminates chemicals from further ecological concern if the maximum value detected is below its EPA Region 4 Screening Value, or the chemical was not detected and the maximum detection limit is below its EPA Region 4 Screening Value. Chemicals are carried to Step 3 of the ERA process. In Step 3 of the ERA process, further lines-of-evidence are evaluated to refine the list of COPCs. Following are some examples of lines-of-evidence that may justify the elimination of a screening level COPC from further ecological concern.

- The frequency at which the chemical is detected
- Alternative toxicity values and/or toxicity data
- The number of samples in which the chemical exceeds its toxicity value
- The number of samples in which the chemical detection limit exceeds its toxicity value
- The magnitude to which the chemical or its detection limit exceeds the toxicity value
- The location of the samples which chemicals exceeding the screening value
- The persistence of the chemical in the environment
- The mean chemical concentration compared to toxicity values
- Comparison to natural background concentrations

Step 2 and 3 of the ERA process for soils for OU1 were completed and provided in the ERA Compendium Step 1 for all Media, Steps 2 and 3 for Soil (ERA Compendium 1) in February 2001.

ERA Step 2 generated the preliminary lists of COPCs for soils associated with the OU1 area. Step 3, Problem Formulation, refined the list of COPCs identified in Step 2 based upon a lines of evidence approach. Since the selected remedy of the OU1 ROD was the removal of all surface soils in the OU1 area, a scientific management decision was made to end the ERA at the Problem Formulation (Step 3). At the time that the COPC refinement was written an area of OU1 soils was expected to be excavated, and samples outside this area were evaluated separately. Lead and total PAH concentrations were below Region 4 screening values in the sample(s) outside the expected excavated area, and because the Region 4 screening values are conservative, EPA had reasonable assurance that the excavation should effectively remove the soils posing a risk to on-site biota. This AROD will address the surface soil in the same manner, but with a greater area of soil being removed.

Based on the May 14, 2001, ERA Compendium 1, all COPCs were eliminated for the OU1 designated area. As a result of the elimination of COPCs for soil, no post OU1 remedy implementation confirmation samples are required for ERA purposes. An ERA Steps 4 through 8 for the area delineated as OU3 has been completed as part of the OU3 risk assessment.

7.6 Human Risk Uncertainty

There are uncertainties which are inherent in the risk assessment process. The calculations and conclusions which are presented in the Baseline Risk Assessment report include uncertainties which may arise from assumptions used in several steps of the assessment. The factors which may lead to either overestimation or an underestimation of the potential adverse effects and associated environmental risks posed by exposure to analytes at the former SGP facility, depending on the relationship of actual conditions to assumptions employed in the calculations, include the following:

- the analytical data presented here may not reflect actual site conditions for all analytes at the present time. Data has been collected during several years of the former facility investigations. However, concentrations in other areas are not expected to be higher than the values presented in the report because the site equipment has been dismantled, activities have ceased, and no new sources have been added. It is expected that the concentrations presented in the report may actually overestimate the true exposure conditions in the future due to processes such as biodegradation and dilution;
- assumptions regarding, for example, body, weight, average human lifetime, and other factors were based on reasonable estimates from available sources and may not be accurate for specific individuals whose characteristics may vary from the conservative general conditions which were assumed. However, standard assumptions were employed in those cases where they were available and professional judgment was applied elsewhere. The report includes references to all values used;
- uncertainties associated with the assumptions have been made regarding the future land use and groundwater use at the Site. What is known about expected land use and groundwater use at the Site is reflected in these exposure assumptions. However, should either the expected land use or groundwater use change, the uncertainty of the conclusion would be increased;
- factors which affect the disposition of absorbed site contaminants, such as metabolism, distribution, bioconcentration and excretion, were not explicitly considered in detail in the intake and risk calculations. Rather, reasonable and conservative assumptions were employed which are unlikely to underestimate the true exposure conditions;
- the mechanism of action for toxicity of the site contaminants is not known with certainty in many cases, particularly regarding their putative carcinogenic effects. The rather specific nature of the carcinogenic effects in animal studies suggests that any extrapolation to humans will be heavily dependent on the assumption which often is not supported by the epidemiological data. This uncertainty is reflected in the recent reevaluation of U.S. EPA approaches to carcinogen assessment. Consistent with standard risk assessment practice, the US EPA Reference Doses (RfDs) and Cancer Slope Factors (CSFs) were used to reflect

toxicity endpoints of interest;

- non-quantifiable uncertainties are inherent in several different aspects of the exposure variables and the estimation of potential human health effects and intake risk calculations. Extrapolation of dose-response curves from high to low dose, from animals to humans and from one exposure route to another introduce uncertainty, intended to be conservative, at each step in the calculated results. The use in the report of established Unit Cancer Risk values (i.e., Carcinogenic Slope Factors) which have been calculated by ostensibly conservative methods (e.g., the linearize multistage model) is unlikely to underestimate the true risk and may overestimate it by a margin which is not quantifiable at present; and
- the intake and risk calculations assume that the exposure conditions can be represented by a deterministic approach which views each variable separately and may result in inappropriate targets if conservative assumptions are “layered” on top of one another. Probabilistic methods are available for such evaluations, but were not employed in this stage of the risk assessment activities.

8.0 REMEDIATION OBJECTIVES

EPA developed a range of alternatives to address the contamination at the Site. The alternatives were based upon the following OU1 remedial action objectives (RAOs):

- Reduce the potential for direct exposure to COCs in surface soils at concentrations above a cancer risk of 1×10^{-6} and a hazard index of 1.0; and
- Reduce the potential for migration of COCs in OU1 soils to groundwater, surface water, and sediment at concentrations that would exceed Remedial Goal Objectives (RGOs) and ARARs for these media.

Specific remedial goals were developed to meet these objectives. The risk assessment identified the remedial goals relative to direct contact or ingestion of soil on various scenarios. The soil cleanup alternatives were based upon on a remedial goal for benzo(a)pyrene of 0.14 mg/kg. Benzo(a)pyrene was used as an "indicator chemical" for the purpose of estimating the amount of soil to be cleaned up. Benzo(a)pyrene is more toxic than the other PAH contaminants. In addition, benzo(a)pyrene and other PAH contaminants are usually found in the same areas. The volume of surface soil to be remediated and subsurface soil to be remediated under this remedy is estimated to be approximately 104,641 cy.

The remedial cleanup goals for the Site were developed specifically to protect human health and to address the risk identified in the Human Health Risk Assessment. These goals are based on available information, standards such as ARARs and the risk-based levels (Remedial Goal Options) established in the Baseline Risk Assessment.

8.1 Surface Soil Remedial Goals

The need for cleanup of surface soil is driven by benzo(a)pyrene, which is directly related to MGP operations. Surface soil is defined as the first two feet of soil. Benzo(a)pyrene is the most widely spread contaminant across the Site and it delineates the outer boundary of the surface soil cleanup area.

The Site is located within a combination of residential, commercial and industrial district of Sanford. The RAO for surface soil is to reduce the potential for direct exposure to COCs in surface soil at concentrations above cancer risk of 1×10^{-6} and a hazard quotient of 1.0, based on an unrestricted residential exposure scenario. Other urban and attributable sources in the vicinity of the Site have contributed COCs to surface soils at concentrations exceeding the residential levels at a cancer risk of 1×10^{-6} . Based on attributable MGP related contaminants and data analysis trends between the former SGP facility and neighboring CSX property both EPA and FDEP has established the Site boundary as presented in Figure 9. Remedial cleanup goals established in the 2000 OU1 ROD for surface soils can be found on Table 14.

8.2 Subsurface Soil Remedial Cleanup Goals

Remedial cleanup goals for subsurface soil contamination have been determined for benzene, naphthalene, ethylbenzene, and total xylenes. These contaminants exceed levels that potentially pose an adverse effect on groundwater quality.

EPA developed alternative soil remedial goals for subsurface contamination. The alternative soil remedial goals are consistent with the planned "hot-spot" subsurface soil remedial approach for the OU1. As referenced in the OU2 groundwater ROD, EPA considers the remedial cleanup goals in Table 14 to be appropriate soil remedial goals for groundwater protection applicable to the Site.

9.0 SUMMARY OF ALTERNATIVES

In considering OUI (soils) RAOs, the analysis presented below reflects the fundamental components of the various alternatives developed to address it. These alternatives have been presented in detail in the RAER dated February 21, 2003.

Alternative 1: No Action

Under the no action alternative, the Site is left "as is" and no funds are expended to actively control or cleanup the Site related contamination and reduction in risk, if any, would be achieved through natural attenuation processes. The no action alternative was developed as required by the NCP, the regulation implementing the Superfund Law. It is used as a baseline for comparing other alternatives. No remedial action for soil or subsurface soils would be taken. Monitoring is considered for a period of 30 years as recommended in the RI/FS Guidance. Without some remedial action, MGP impacts at the Site would continue to exceed RGOs or ARARs beyond 30 years. Site access would be required from third-party property owners where monitoring activities would take place. The monitoring wells would be sampled for benzene, ethylbenzene, and naphthalene in accordance with EPA OU2 ROD. The only cost associated with this alternative relates to ground water monitoring. Mobility, toxicity and volume are not reduced by this remedy.

Alternative 2: Institutional and Engineering Controls

Under this alternative, a number of Institutional Controls would be implemented to reduce the potential risk associated with exposure to impacts at the Site. Institutional Controls would include restricting property for industrial or commercial use only (non-residential use); restricting unauthorized excavation on the property (authorized excavation would require a health and safety plan and oversight); allowing no water supply wells to be drilled without EPA and FDEP approval; fencing to mitigate the potential for trespassers to access the area; and placing deed restrictions on properties notifying present and future property owners of the presence of impacted soil in the subsurface. In addition, this alternative would include groundwater monitoring for 30 years.

Alternative 3: Vegetated Soil Cap and Drainage Improvements

This alternative would involve approximately a vegetative soil cover and drainage improvements to convey surface water for the Site, West 6th Street, and along the unnamed tributary to Cloud Branch Creek. The vegetated cover would serve to prevent surface water from coming into contact with impacted soil and/or groundwater. This alternative would also mitigate the potential for direct human contact with impacted surface soil.

Drainage improvements would consist of surface water conveyance system that would include two catch basins along West 6th Street and three within the Cedar Avenue ROW connected via an underground storm sewer that would discharge to Cloud Branch Creek at its confluence with the

unnamed tributary. All joints in the storm sewer system would be sealed to prevent infiltration of impacted soil and groundwater. Approximately 650 linear ft of storm sewer pipe would be necessary to run from the catch basins in West 6th Street to Cloud Branch Creek. The storm water pipe would be approximately 24 inch in diameter and would consist of fiberglass mortar pipe with joints wrapped in fiberglass to create a watertight connection or concrete pipe with gasket seals and joints wrapped in bitumen to reduce infiltration. The land surface would be graded so surface water would drain to the catch basins.

After clearing and construction of the drainage improvements, the area would be rough graded and then filled. Final grading would provide for appropriate surface water drainage, and the cover would then be seeded or sodded. This alternative would also include groundwater monitoring for 30 years and Institutional Controls, as discussed under Alternative 2. Subsurface soil impacts would not be addressed under this alternative.

Alternative 4: Low-Permeability Cap and Drainage Improvements

This alternative would involve the construction of a cap, to prevent surface water from coming into contact with impacted soil and/or groundwater and mitigate the potential for direct contact with contaminated surface soil. Cap construction would be achieved using a low-permeability geosynthetic membrane, and would be accompanied by drainage improvements from Alternative 3 and Institutional Controls from Alternative 2, and groundwater monitoring for 30 years. Annual inspections would be conducted and repairs would be made, if necessary. This alternative would also mitigate the potential for direct human contact with impacted surface soil. Under this alternative subsurface soils would not be addressed.

Alternative 5: Pumping and Treating Groundwater

This alternative would involve pumping and treating of groundwater that passes through impacted OUI soils to capture the impacts that could be migrating from soil to groundwater. The installation of a system of groundwater recovery wells down gradient from the area of impacts between West 3rd and West 4th Streets would be expected to recover groundwater and to prevent the migration of subsurface soil impacts from OUI designated area. The final number and placement of recovery wells and design would be determined as part of the remedial design process. The groundwater capture zone produced by the recovery wells would be at the leading edge of the groundwater plume and would straddle Cloud Branch Creek south of West 3rd Street.

The groundwater would be discharged to the City of Sanford's publicly owned treatment works (POTW) or surface water. Prior to discharge, phase separation, filtration, and carbon adsorption are anticipated for compliance with City of Sanford or surface water discharge requirements. As part of the system design, a pumping test would be conducted to select the size of the recovery pumps, piping, and treatment equipment.

This alternative would also incorporate Institutional Controls from Alternative 2, a vegetated soil cover and drainage improvements from Alternative 3, and limit migration from surface soil to surface waters/sediments. Groundwater monitoring would be performed for 30 years. This alternative would also mitigate the potential for direct human contact with impacted surface soil. Subsurface soil impacts would not be addressed under this alternative.

Alternative 6: Low-Permeability Cap with Slurry Wall

This alternative would consist of a low-permeability geosynthetic membrane cap, detailed in Alternative 4, and a vertical barrier installed around the area of OUI impacts to control the horizontal groundwater flow. The cap would serve to prevent surface water from coming into contact with impacted surface soil and/or groundwater. The barrier would create a wall from the cap to the confining unit. The slurry wall may consist of a bentonite/Portland cement slurry installed by either a backhoe bucket or series of borings of sufficient diameter and overlap as to prevent groundwater passage. Groundwater recovery within the slurry wall is necessary to ensure that the gradient is always inward, toward the subsurface impacts. Groundwater monitoring would be conducted for 30 years and Institutional Controls would be implemented as indicated in Alternative 2. This alternative would also mitigate the potential for direct human contact with impacted surface soil.

Alternative 7: Excavation and Landfill Disposal

This alternative would include soil excavation with off-site disposal at a permitted RCRA Subtitle D landfill. The anticipated depth of the excavation would range from 2 ft to approximately 30 ft bls. The deepest excavation areas would be advanced to the top of the clay layer that underlies the Site area.

Remediation of a relatively thin layer of soil that appears to have been impacted when NAPL contamination migrated laterally across the upper surface of the clay layer that underlies the Site area is required. The majority of this area is located between West 3rd and West 4th Streets. The NAPL-impacted soil layer ranges in thickness from several inches to 10 ft. These impacts are overlain by approximately 16 to 28 ft of non-impacted soil.

A portion of the excavated surface soil would be used as backfill material. Prior to its use as backfill within the subsurface excavation area, surface soil would be sampled and analyzed for groundwater protection levels. Any surface soil determined analytically to have levels not protective of groundwater would be transported to a RCRA Subtitle D landfill for disposal along with excavated subsurface soil. Soils from an off Site borrow source area would be used as backfill at the Site.

Following excavation and backfilling, Site restoration work would include, but would not be limited to the reconstruction of roads, curbing, sidewalks, paved areas, buildings, recreation areas, and utilities.

Alternative 8: Excavation and Off-Site Thermal Treatment

This alternative is identical to Alternative 7, with the exception that all excavated soils would be transported off Site to a low-temperature thermal desorption unit (LTTD), rather than disposed of in a landfill. A portion of the excavated surface soil would be used as backfill material. Prior to its use as backfill within the subsurface excavation area, surface soil would be sampled and analyzed for groundwater protection levels. Thermally treated soil would not be returned to the Site. Instead, soils from an off Site borrow source area would be used as backfill, in combination with non-impacted soil overlain NAPL impacts. The Site would be restored as described in

Alternative 7.

An estimated average of 500 tons (approximately 25 truckloads) of soil would be transported off Site for disposal, either for thermal treatment or landfill, each day that soil excavation work is performed for an approximate period of 16 to 18 months.

Alternative 9: Excavation with Non-NAPL Impacts to Landfill and Blended NAPL Impacts to Off-Site Thermal Treatment

This alternative combines Alternatives 7 and 8, in such a manner that soil would be excavated and transported off Site for disposal by either LTTD or landfill. NAPL-impacted soil would be blended on Site and thermally treated off Site, and non-NAPL impacts would be disposed off in a landfill. Similar to Alternatives 7 and 8 soil exceeding groundwater protection levels would be transported off Site for either thermal treatment or disposal. A portion of the excavated surface soil would be used as backfill material. Prior to its use as backfill within the subsurface excavation area, surface soil would be sampled and analyzed for groundwater protection levels. The excavation area would be backfilled with qualifying surface soil, non-impacted soil overlying NAPL impacts, and soils from an off Site borrow source. The Site would be restored as described in Alternative 7.

An estimated average of 800 tons (approximately 40 truckloads) of soil would be transported off Site for thermal treatment or landfill disposal each day that soil excavation work is performed for an approximate period of 10 to 12 months.

Alternative 10: Excavation and On-Site Thermal Treatment

This alternative is similar to Alternatives 7 and 8 in most respects, with the principal difference being the use of on-site thermal treatment of soil using a mobile LTTD unit. Soil exceeding groundwater protection levels would be treated using the on-site LTTD unit. Surface soil meeting groundwater protective levels would be utilized as backfill within the subsurface soil excavation. In contrast to Alternative 8, thermally treated soil that has been shown to have met groundwater protective levels through the use of a quality control testing program would be returned to the excavation for use as backfill. Limited use of an off-site borrow source area would be used as backfill.

An estimated average of 800 tons (approximately 40 truckloads) of soil would be thermally treated on Site each day that soil treatment takes place for a period of 9 to 11 months.

Alternative 11: In-Situ Solidification/Stabilization (ISS) and off-site Disposal

This alternative would use a combination of remedial technologies to address shallow and deep subsurface soil impacts. The deepest soil impacts would be treated using ISS. Comparatively shallower soil would be excavated to accommodate the ISS process and would be disposed off Site in a RCRA Subtitle D landfill. The combination of ISS and off-site disposal would address soil impacts exceeding the groundwater protection levels and would achieve residential levels for surface soil.

The ISS treatment would include injection of a treatment reagent (i.e., Portland Cement) into the subsurface soil while the soil is mixed in-Situ using appropriate heavy construction equipment (i.e., a large diameter auger). The auger would be advanced through the soil and a reagent would be injected into the entire column of subsurface soil that exceeds groundwater protection levels. The simultaneous reagent injection and auger-driven in-Situ mixing would homogenize the soil creating a stable, low-permeability, monolithic mass that cures to achieve an average unconfined compressive strength ranging from 50 to 200 pounds per square inch.

Bench and pilot scale testing would be required under this alternative. Bench-scale testing would be conducted as a part of the remedial design process. This work would involve mixing a variety of reagents at varying concentrations with Site-area soil types to select the optimal reagent and injection rate.

The anticipated depth of in-Situ treatment would range from 2 to approximately 30 ft bls. The deepest treatment areas would be advanced to the top of the clay layer that underlies the Site area.

Soil excavated to account for bulking and surface soil that exceeds residential levels would be transported off Site to a RCRA Subtitle D landfill for disposal. Soil excavated to account for bulking that does not exceed residential levels would be used as clean fill for the final soil cap.

Alternative 12: Excavation, Off-Site Landfill, Off-Site Thermal Treatment of Shallow Soil and ISS

This alternative would use a combination of technologies to remediate the shallow and deep soils. Areas of shallow soil impacts would generally be remediated using excavation followed by either off-site disposal at a RCRA Subtitle D facility or off-site thermal treatment. Areas of deep soil impacts would be remediated using ISS. The combination of excavation, off-site disposal at landfill, off-site thermal treatment and ISS would address soil impacts exceeding the groundwater protection levels. The soil remediation-related construction and restoration work is anticipated to take approximately 12 to 15 months under this alternative.

As discussed in Alternative 11, ISS treatment would include injection of a Portland-cement treatment reagent into impacted subsurface soil while the soil is mixed and homogenized in situ using an auger. The result would be the creation of a stable, low-permeability, monolithic mass that obstructs the passage of groundwater flow through the treated soil isolating MGP-related impacts from groundwater. All other technical aspects of this technology are explained under Alternative 11.

Under this alternative, the depth of the soil excavation for off-site disposal in a landfill and/or off-site thermal treatment would range from 2 ft to 8 ft bls. The depth of in-situ treatment would extend as deep as 30 ft bls. The deepest treatment areas would be advanced to the top of the clay layer that underlies the Site area.

OTHER ALTERNATIVES

In addition to the alternatives presented in this ROD other alternatives were considered as well. Those considered were: Ex-Situ Soil Washing, Ex-Situ S/S, In-Situ Air Sparging/Soil Vapor Extraction, In-Situ Chemical Oxidation, MNA, and Soil Flushing. Some of the alternatives were not retained because the options would not provide the overall level of effectiveness required. Others alternatives were not considered further because they were not likely to achieve clean up goals in large mass of NAPL. Each of these alternatives were studied as a potential alternative to treat the entire Site. However, some of these alternatives could be used to treat small non-NAPL contaminated areas with success. Such areas can be found in the Site perimeter boundary of the NAPL contaminated area and are characterized by a thin or slight sheen on the water table or where no visible impacts are present, yet concentration criteria for one or more of the COCs (i.e., benzene and/or naphthalene) are exceeded.

One option of interest to EPA is In-Situ Chemical Oxidation. This alternative is considered a viable option to address certain MGP-related soil impacts, working most effectively and efficiently on impacts that are not free-phase (also referred as non-NAPL) in composition.

Chemical Oxidation converts hazardous contaminants to non-hazardous or less toxic compounds that are stable, less mobile, and/or inert. Chemical oxidizing agents are delivered to the subsurface soil through a system of horizontal and/or vertical injection wells. The chemical oxidants most commonly employed to date, include peroxide, ozone and permanganate. These oxidants have been able to cause the rapid and complete destruction of many toxic organic chemicals (i.e., trichloroethylene and benzene). Bench and pilot scale testing would be necessary to determine the appropriate oxidant for benzene and other COCs.

Chemical Oxidation will be retained by EPA as a complimentary treatment to the ISS in those perimeter areas that have soil characteristics as previously described. Some of the oxidants may temporarily lower the pH in the groundwater. If such reagents are used, the nearby ISS areas will be protected from the oxidation reagents.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

EPA has established nine criteria which are used in comparing the advantages and disadvantages of each alternative.

The alternatives are evaluated against one another by using the following nine criteria:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short term effectiveness
- Implementability
- Costs
- State Acceptance
- Community Acceptance

The NCP has categorized the nine criteria into three groups:

- (1) Threshold criteria: the first two criteria, overall protection of human health and the environment and compliance with ARARs (or invoking a waiver), are the minimum criteria that must be met in order for an alternative to be eligible for selection;
- (2) Primary balancing criteria: the next five criteria are considered primary balancing criteria and are used to weigh major trade-offs among alternative cleanup methods; and
- (3) Modifying criteria: state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan. Community acceptance is addressed in the responsiveness summary of the ROD.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment would be achieved under Alternatives 3 through 12 since the potential for direct human exposure to contaminated surface soil would be eliminated through capping or soil removal. These alternatives would provide the greatest degree of protection because the surface soil would be either excavated, contained, treated, and/or disposed.

Alternative 1 would not be protective of human health. Therefore, it is eliminated from further consideration. Alternative 2 would offer only restricted use of the property and will not completely eliminate site exposure or human health risk. Therefore, it is also eliminated from

further consideration.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 3 through 12 can be designed to attain ARARs.

Long-Term Effectiveness and Permanence

Alternatives 3 through 12 achieve long-term effectiveness and permanence because they either provide treatment, disposal, containment or capping. In addition, Institutional Controls provide restrictions and limits on what could be done once the remedy is implemented. Alternatives 7 through 12 are the most effective because in addition to removing the first two feet of soil, these options would also remove, dispose or treat all soils to meet the remedial cleanup goals for surface soils and/or subsurface soils. Alternative 3 through 6 can be designed to accomplish long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume

Alternatives 7 through 10 would be the most effective in reduction of toxicity, mobility or volume through excavation and off-site disposal or on-site treatment. Alternatives 7 and a portion of Alternative 9, would move the contaminated soil to an off Site secured location; however, such an action would not offer the benefit of reducing toxicity. Alternatives 3 through 6 would be effective in reducing mobility, however, they would not reduce toxicity and volume. Alternative 8 and a portion of Alternative 9, Off-site thermal treatment, would require the excavated soil to be sent to a permitted commercial facility to be thermally treated, thus destroying the contaminants before disposal. Alternative 11, Solidification/Stabilization, and a portion of Alternative 12, would increase the volume of the contaminated subsurface soil due to bulking of soil while adding stabilizing reagents; however, the alternative would reduce mobility and toxicity.

Short-Term Effectiveness

Alternatives 3 through 6 would provide the most short-term effectiveness. These alternatives would cause the least impacts to workers and the community, since contaminated soil is not excavated, and would minimize the potential for air releases during construction activities. Alternatives 7 through 12 would increase the potential for exposure to workers and the community due to the excavation, dust and increase of vehicular traffic. Engineering controls would be developed during the design to limit negative impacts.

Implementability

Alternatives 3 and 4 would be the most implementable as they involve capping contaminated soils in-place. Alternatives 5 and 6 would be the next most implementable treatment alternatives since they could be implemented over a relatively short period of time. Alternatives 7, 8, 9, 11 and 12 would utilize conventional construction techniques and has a large pool of experienced contractors. Alternative 10, because of pilot test requirements and availability of equipment, would be the most difficult to implement.

Cost

The most costly alternative would be Alternative 8. The least costly alternative would be Alternative 3, other than the No Action and Engineering/Institutional Controls alternatives. A summary of the present worth costs, which includes capital as well as the operation and maintenance (O&M) costs for each of the alternatives is presented in Table 15. Costs analysis for all alternatives were provided by the Sanford PRP Group.

Overall Protection of Human Health and the Environment; Compliance with ARARs; Reduction of Toxicity, Mobility, or Volume; Long-Term Effectiveness and Permanence; and Short-Term Effectiveness are also to be considered and have more weight as the basis for the remedy selection. EPA does not use cost as the primary basis for the selection. However, EPA does take into consideration the cost effectiveness of an alternative.

State Acceptance

In accordance with 40 CFR 300.430, the State of Florida has been involved in the process and has not expressed an opposition to the proposed alternative.

Community Acceptance

During the comment period for the Proposed Plan for the AROD no comments were received from the community. Based on this observation, it is EPA understanding that the community is not opposed to the selected remedy.

11.0 SELECTED REMEDY

After reviewing the information available and after careful consideration of the various alternatives, EPA has selected a combination of In-Situ Solidification/Stabilization and off-site Disposal with optional Chemical Oxidation in non-NAPL areas.

11.1 Description of Remedy

This alternative will use a combination of remedial technologies to address shallow and deep subsurface soil impacts. The deepest soil impacts will be treated using ISS. Comparatively shallower soil will be excavated to accommodate the ISS process and will be sent for off-site landfill disposal. The combination of ISS and off-site landfill disposal will address soil impacts exceeding the groundwater protection levels and achieve residential levels for surface soil.

The ISS treatment will include injection of a treatment reagent (i.e., Portland Cement) into the subsurface soil while the soil is mixed in-Situ using large construction equipment (typically 3 to 10-foot diameter auger). The auger will be advanced through the soil and the reagent will be injected into the entire column of subsurface soil that exceeds groundwater protection levels. The simultaneous reagent injection and auger-driven in-Situ mixing will homogenize the soil creating a stable, low-permeability, monolithic mass that cures to achieve an average unconfined compressive strength ranging from 50 to 200 pounds per square inch. Most importantly, the void space between soil particles will be occupied by the reagent, resulting in a permeability reduction of several orders of magnitude and will obstruct the passage of groundwater flow through the soil mass.

The ISS technology will negate the need for significant dewatering and most earth support systems. The need for soil excavation work under this alternative will be relatively limited. For the sandy soils types encountered at the Site, bulking is estimated to be approximately 20 to 25 percent by volume.

Soil excavated to account for bulking and surface soil that exceeds residential levels will be transported off Site to a RCRA Subtitle D landfill for disposal. Soil excavated to account for bulking that does not exceed residential levels can be used without restrictions as clean fill for the final soil cap or as fill material in other areas. A relatively thin layer of NAPL-impacted soil is present above the clay layer beneath the non-impacted overburden. The non-impacted overburden may have to be solidified as well, for the following reasons; (1) advancement of the mixing augers may require reagent for lubrication to advance the augers; and (2) after successful treatment of the deep impacts, withdrawal of the augers through the untreated and non-impacted overburden soil may have the potential to result in the spread of impacts to non-impacted soil.

Bench and pilot scale testing will be required. Bench-scale testing will be conducted as a part of the remedial design process. This work will involve mixing a variety of reagents at varying concentrations with Site-area soil types to select the optimal reagent and injection rate. Prior to

implementation, a pilot program will be undertaken to confirm that the selected reagent is appropriate, to verify the amount of reagent that must be injected to achieve the design permeability and compressive strength and to assess the amount of bulking to be expected during full-scale operation. As part of the bench and pilot programs, unconfined compressive strength, permeability and leachability characteristics of the treated soil will be examined.

The anticipated depth of in-Situ treatment will range from 2 to approximately 30 ft bls. The deepest treatment areas will be advanced to the top of the clay layer that underlies the Site area. The estimated total volume of surface and subsurface soil to be remediated is 142,000 cy (191,000 tons). This will include the treatment of approximately 95,700 (129,000 tons) of subsurface soil, including approximately 26,700 cy (36,000 tons) of non-impacted soil overlying NAPL impacts, and off-site landfill disposal of approximately 46,100 cy (62,300 tons) of surface and subsurface soil.

In addition to the ISS technology, as previously discussed, EPA will retain Chemical Oxidation as a means to address those perimeter areas that fall under certain non-NAPL characteristics. Since, these potential areas are estimated to be small in comparison to the most contaminated areas no cost has been estimated for them. The cost of the possible implementation of this option is estimated to cause no significant change in the total cost of the entire remedy. Bench and pilot scale testing will be necessary to determine the appropriate oxidant for benzene and other COCs.

As part of the site restoration plan, the topography of the Site could be raised to reduce the potential for flooding and make currently unusable land usable. Grade changes could be made by adjusting the degree of pre-SS excavation, or placement of backfill within the areas targeted for grade modification. Positive grade changes within Cedar Avenue ROW will be accompanied by construction of a storm sewer line conveying stormwater from West 6th Street to Cloud Branch Creek.

This remedy will require the implementation of an Operation and Maintenance Plan after its construction. A review will be conducted every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

11.2 Institutional and Engineering Controls

Institutional Controls will be required as part of the selected remedy. This Record of Decision establishes the Institutional Controls to be implemented. Currently, the area delineated as OU1 is owned by: FPUC, CPM, Armand Enterprises, CSX Inc., Codisco Inc., and the City of Sanford. The Site is zoned as Restricted Industrial (RI-1) and General Commercial (GC-2). The Restricted Industrial designation is described as areas which "are intended for light wholesale and manufacturing uses and related accessory use." The General Commercial (GC-2) designation is described as areas which "accommodate community-oriented retail sales and services; highway-oriented sales and services; and other general commercial activities." Other adjacent land uses include multi-family residential, general commercial, and restricted industrial land use.

Institutional Controls are non-engineering measures which usually include legal controls to affect human activities in such a way so as to prevent or reduce exposure to contamination. The purpose of the Institutional Controls is to impose on the subject property "use" restrictions which run with the land for the purpose of implementing, facilitating and monitoring a remedial action to reduce exposure, thereby protecting human health and the environment. Institutional Controls which are required for the subject property will be implemented after construction of the remedy and must be drafted in accordance with FDEP's Institutional Controls Procedures Guidance (dated November 2004). A restrictive covenant will document the requirements and restrictions placed on the subject property and will be filed with the county land office. Some of the controls which will be generally implemented include, but are not limited to, the following:

- a. No well shall be installed without FDEP and EPA's written approval and no groundwater shall be use for any other purpose other than monitoring for contamination purposes;
- b. No excavation shall occur in any of the treated areas without written approval from EPA and FDEP; and
- c. Provide permanent access to subject property to EPA and FDEP and their agents and/or representatives.

The Sanford PRP Group is responsible for implementing the restrictive covenant with FDEP and will submit all associated documents as a part of the Construction Completion Report, 120 days after the remedy has been completed in order for EPA to issue the Construction Completion Certificate.

11.3 Summary of the Estimated Remedy Costs

The total estimated cost of the selected alternative, including Engineering and Institutional Controls, is approximately \$11,200,000.00. The detailed costs are presented in Tables 16 and 17.

11.4 Expected Outcome of Selected Remedy

The purpose of this action is to reduce the potential for direct exposure to COCs in surface soils at concentrations above a cancer risk of 1×10^{-6} and a hazard index of 1.0 and to reduce the potential for migration of COCs to groundwater, surface water, and sediment at concentrations that will exceed the remedial cleanup goals and ARARs for these media. Remedial cleanup goals for the COCs is presented in Table 14. The remedy will also reduce the migration of contaminants from soil into groundwater. Remedial cleanup goals developed to protect groundwater were established in the OU2 groundwater ROD. It is expected that it will take about 12 to 15 months for implementation of this remedy.

12.0 STATUTORY DETERMINATIONS

EPA has determined that the selected remedy will satisfy the statutory determinations of Section 121 of CERCLA. The remedy will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will use permanent solutions and alternative treatment technologies to the maximum extent practicable.

12.1 Protection of Human Health and the Environment

The remedy will eliminate the potential risks for future residents and commercial workers from exposure to contaminated surface soil. The potential risks are eliminated because the soil above the selected remedial cleanup goals for surface soil will be removed and disposed off-site.

The selected remedy reduces both the potential risk of soil contaminant migration to groundwater and further groundwater contamination, since it treats and/or removes the subsurface soil contaminants which are the source of the groundwater contamination. A final remedy for groundwater was documented in OU2 ROD.

The resulting exposure levels will be reduced to ARAR levels of 1×10^{-6} for carcinogens and below the HI of 1 for non-carcinogens within the Site boundaries.

12.2 Compliance with ARARs

The selected remedy will comply with the substantive requirements of Federal ARARs and State ARARs listed in Table 18.

12.3 Cost Effectiveness

EPA evaluated all of the alternatives which satisfy the two threshold criteria, protection of human health and the environment and attainment of ARARs. Section 300.430(f)(1)(ii)(D) of the NCP also requires EPA to evaluate three out of five balancing criteria to determine overall effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. EPA has concluded that the Selected Remedy, In-Situ Solidification/Stabilization and off-site Disposal with optional Chemical Oxidation in non-NAPL areas, affords the highest level of overall effectiveness proportional to its cost.

12.4 Utilization of Permanent Solutions or alternative treatment technologies to the maximum extent practicable

This remedy will be a permanent solution for the surface and subsurface soils at the Site in that all contaminated soil above the remedial cleanup goals within Site boundaries will be treated

and/or removed off-site, thus preventing direct exposure to human contact and the leaching of contaminants to the groundwater. This is a common treatment method used for MGP waste at Superfund sites.

12.5 Preference for Treatment

The preference for treatment is satisfied because the contaminated source material will be treated and/or removed for off-site disposal. The selected remedy is a widely used and accepted treatment for MGP wastes among different EPA Regions across the United States.

12.5 Five-Year-Review Requirement

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

12.6 Explanation of Significant Changes

This AROD documents significant changes from the previously selected remedy. Due to the findings gathered during the DSAP, which indicated the actual volume of soil contamination which needed to be remediated was approximately 4.5 times the original estimated quantity, EPA recognized the need to re-evaluate its previous remedy selection.